Upstream Occlusion Assembly, DWG 86878

(Optional Device)

Table 14 (Reference Figure 14)

ITEM	PART NO.	QTY	DESCRIPTION
A10	87340	1	IC LM317LZ
A11	87341	1	IC CD4046BCN
A12	87242	1	IC LM329M
A13	87343	1	IC CD4040BCN
A14	87344	1	IC CD4073BCN
A15	REF	REF	REF JA15 – DWG 86896
A16	70319	1	IC CD4013BEX
C100	87380	1	Capacitor .33uf 20% Tantalum
C101	87381	1	Capacitor .01uf 10% 50 V
C102	87381	1	Capacitor .01uf 10% 50 V
C103	87382	1	Capacitor 390pf 5%
C104	87383	1	Capacitor 560pf 5%
C105	87381	1	Capacitor .01uf 10% 50V
C106	87389	1	Capacitor 82pf 5%
C107	87384	1	Capacitor 0.1uf 10%
C108	87384	1	Capacitor 0.1uf 10%
C109	87385	1	Capacitor 470pf 5%
C110	87386	1	Capacitor 68pf 5%
C111	87387	1	Capacitor 1.0uf 20% Tantalum
C112	87384	1	Capacitor 0.1uf 10%
C113	87384	1	Capacitor 0.1uf 10%
C114	87384	1	Capacitor 0.1uf 10%
C115	87384	1	Capacitor 0.1uf 10%
C116	87388	1	Capacitor 1000pf 10%
C117	87384	1	Capacitor 0.1uf 10%
C118	87384	1	Capacitor 0.1uf 10%
C119	87387	1	Capacitor 1.0uf 20% Tantalum
R100	87350	1	Resistor .125ohm 1%
R101	87351	1	Resistor .604ohm 1%
R102	87352	1	Resistor Potentiometer 100ohm
R103	87353	1	Resistor 30ohm 5%
R104	87354	1	Resistor 20k 5%
R105	87355	1	Resistor 3.57k 1%
R106	87356	1	Resistor 8.87k 1%
R107	87357	1	Resistor 22.1k 1%

Upstream Occlusion Assembly, DWG 86878

(Optional Device)

Table 14 (Reference Figure 14)

ITEM	PART NO.	QTY	DESCRIPTION
R112	87358	1	Resistor 27.4k 1%
R112a	87369	1	Resistor Potentiometer 10k
R113	87359	1	Resistor 2.74k 1%
R114	87360	1	Resistor 12.1k 1%
R115	87631	1	Resistor 100ohm 1%
R118	87364	1	Resistor 100k 5%
R119	87365	1	Resistor 10k 5%
R120	87364	1	Resistor 100k 5%
R121	87366	1	Resistor 1M 5%
R122	87364	1	Resistor 100k 5%
R123	87354	1	Resistor 20k 5%
R124	87367	1	Resistor 3.32k 1%
Q10	87330	1	Transistor MMBT5088
Q11	87331	1	Transistor MMBT2369A
CR1	86641	1	LED HLMP-M501
BD	86860	1	Blank PCB
J2	87336	1	3-Pin Connector
PEM	87335	2	PEM Insert KFS2-440
TP1	87334	1	Test Point Pin
TP2	87334	1	Test Point Pin
TP4	86898	1	Test Point Pin
TP5	86898	1	Test Point Pin
TP6	86898	1	Test Point Pin
FT1	86898	1	Test Point Pin

Temperature Compensation PCB Assembly
Dwg. 86896 (Optional Device)

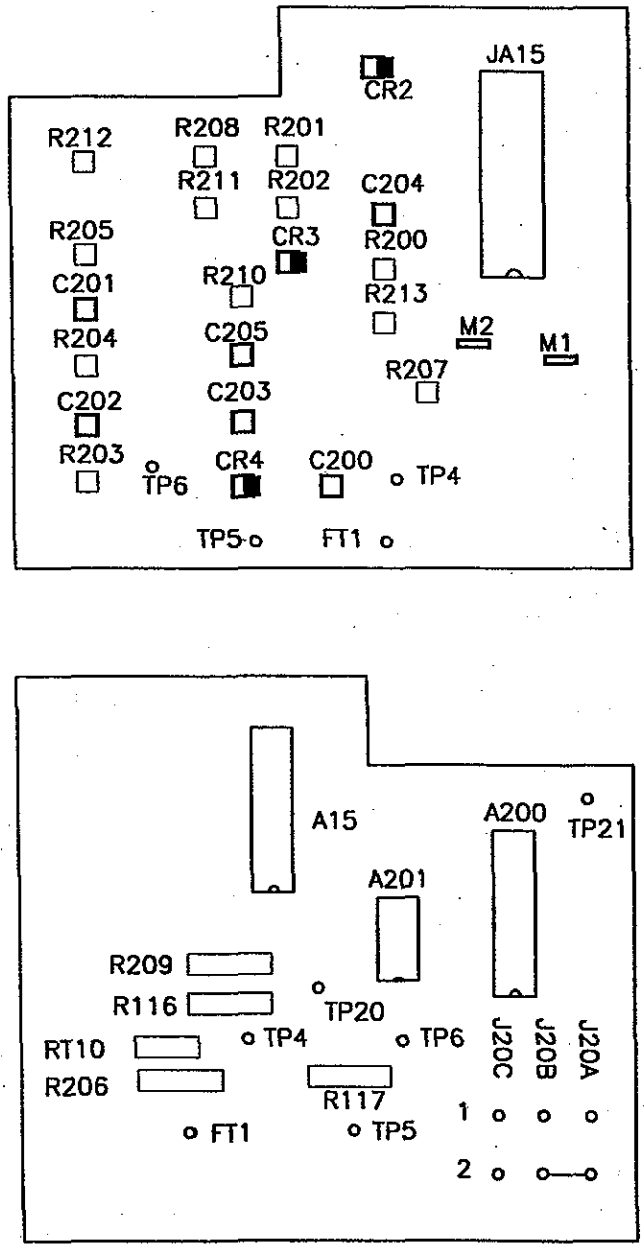
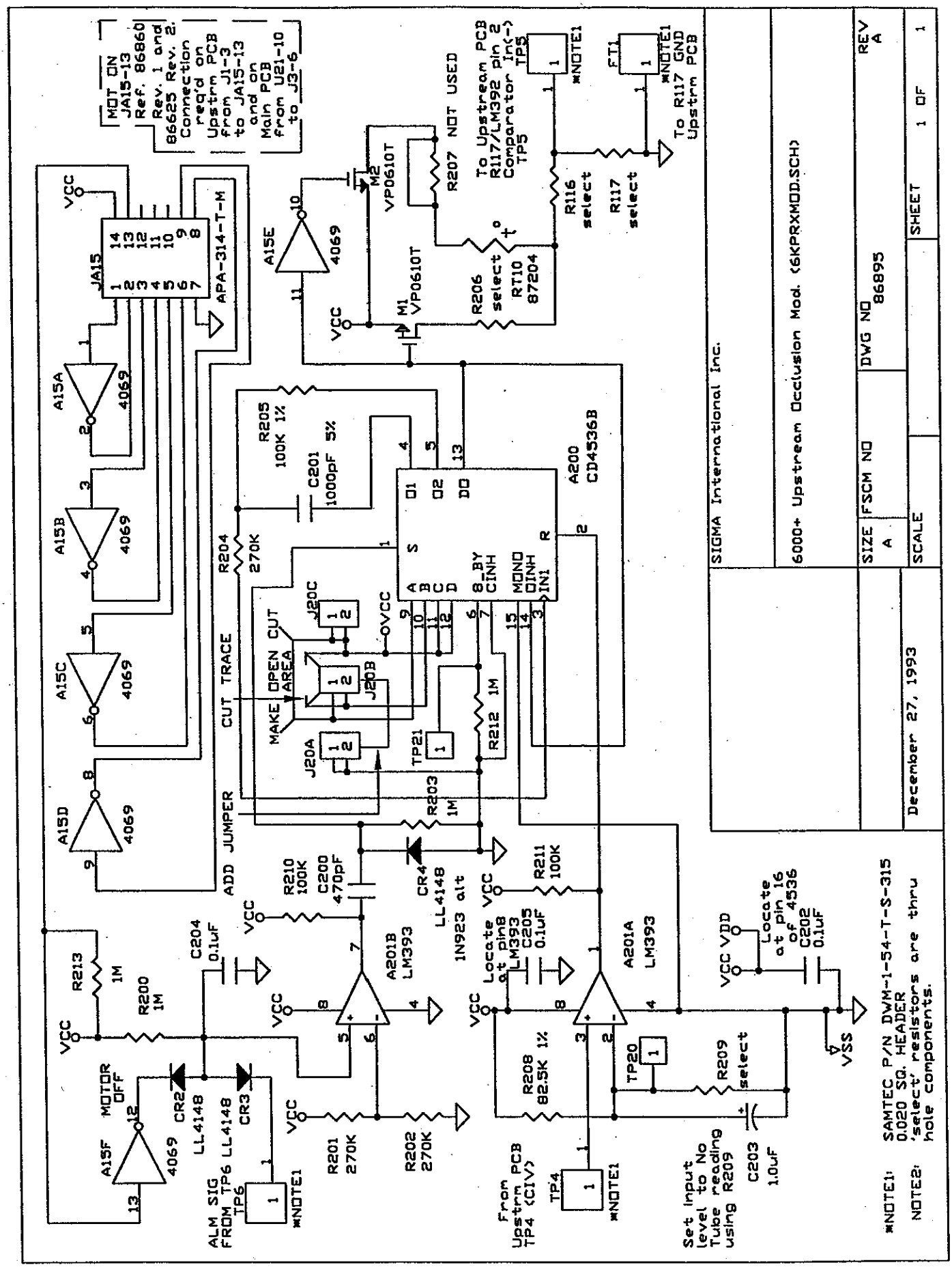


Figure 15


MOT ON JA15-13 Ref. 86860 Rev. 1 and 86625 Rev. 2. Connection reqd on Upstrm PCB from J1-3 to JA15-13 and on Main PCB from U21-10 to J3-6
JA15
APA-314-T-M
A15A 4069
A15B 4069
A15C 4069
A15D 4069
A15E 4069
A15F 4069
VCC
R213 1M
R200 1M
C204 0.1uF
MOTOR OFF
CR2 LL4148
CR3 LL4148
ALM SIG FROM TP6
TP6
*NOTE1
R201 270K
R202 270K
R205 100K 1%
C201 1000pF 5%
R204 270K
CUT TRACE
MAKE OPEN AREA
CUT
J20C
J20B
J20A
TP21
R212 1M
R203 1M
ADD JUMPER
A200 CD4536B
D1 D2 DD
S A B C D
8_BY CINH
MONO CINH
IN1 R
R210 100K
C200 470pF
CR4 LL4148 alt 1N923
R211 100K
A201B LM393
A201A LM393
Locate at pin8 LM393
C205 0.1uF
Locate at pin 16 of 4536
C202 0.1uF
VCC VDD
VSS
R208 82.5K 1%
TP20
R209 select
C203 1.0uF
Set input level to No Tube reading using R209
From Upstrm PCB TP4 (CIV)
TP4
M2 VP0610T
M1 VP0610T
R207 NOT USED
R206 select
RT10 87204
To Upstream PCB R117/LM392 pin 2 Comparator In(-) TP5
R116 select
R117 select
FT1
To R117 GND Upstrm PCB
*NOTE1: SAMTEC P/N DWM-1-54-T-S-315 0.020 SQ. HEADER
NOTE2: 'select' resistors are thru hole components.
SIGMA International Inc.
6000+ Upstream Occlusion Mod. (6KPRXMOD.SCH)
SIZE A
FSCM NO
DWG NO 86895
REV A
SCALE
SHEET 1 OF 1
December 27, 1993

Temperature Compensation PCB Assembly, DWG 86896

(Optional Device)

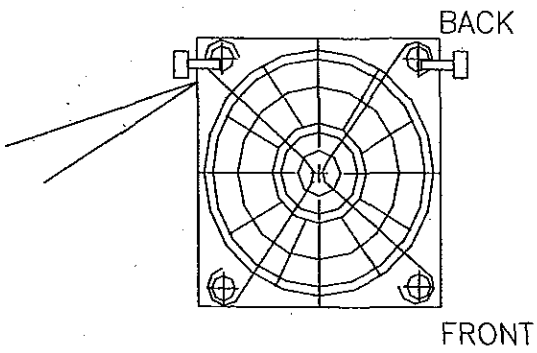
Table 15 (Reference Figure 15)

ITEM	PART NO.	DESCRIPTION
R116	-	Resistor (Selected at Setup)
R117	-	Resistor (Selected at Setup)
R200	87366	Resistor 1M 5%
R201	87373	Resistor 270K 5%
R202	87373	Resistor 270K 5%
R203	87366	Resistor 1M 5%
R204	87373	Resistor 270K 5%
R205	87374	Resistor 100K 1%
R206	-	Resistor (Selected at Setup)
R208	87375	Resistor 85.5K 1%
R209	-	Resistor (Selected at Setup)
R210	87374	Resistor 100K 1%
R211	87374	Resistor 100K 1%
R212	87366	Resistor 1M 5%
R213	87366	Resistor 1M 5%
RT10	87204	Thermistor 10K 5%
C200	87385	Capacitor 470pf 5%
C201	87388	Capacitor 1000pf 5%
C202	87384	Capacitor 0.1uf 10%
C203	87387	Capacitor 1.0uf 20%
C204	87384	Capacitor 0.1uf 10%
C205	87384	Capacitor 0.1uf 10%
CR2	87348	IC IN923
CR3	87348	IC IN923
CR4	87348	IC IN923
A200	87346	IC CD4536B
A201	87347	IC LM393
A15	87345	IC 4069
M1	87332	FET VP0610T
M2	87332	FET VP0610T
JA15	86897	14-Pin Connector
FT1	86898	Test Pin
TP4	86898	Test Pin
TP5	86898	Test Pin
TP6	86898	Test Pin
TP20	86898	Test Pin
TP21	86898	Test Pin

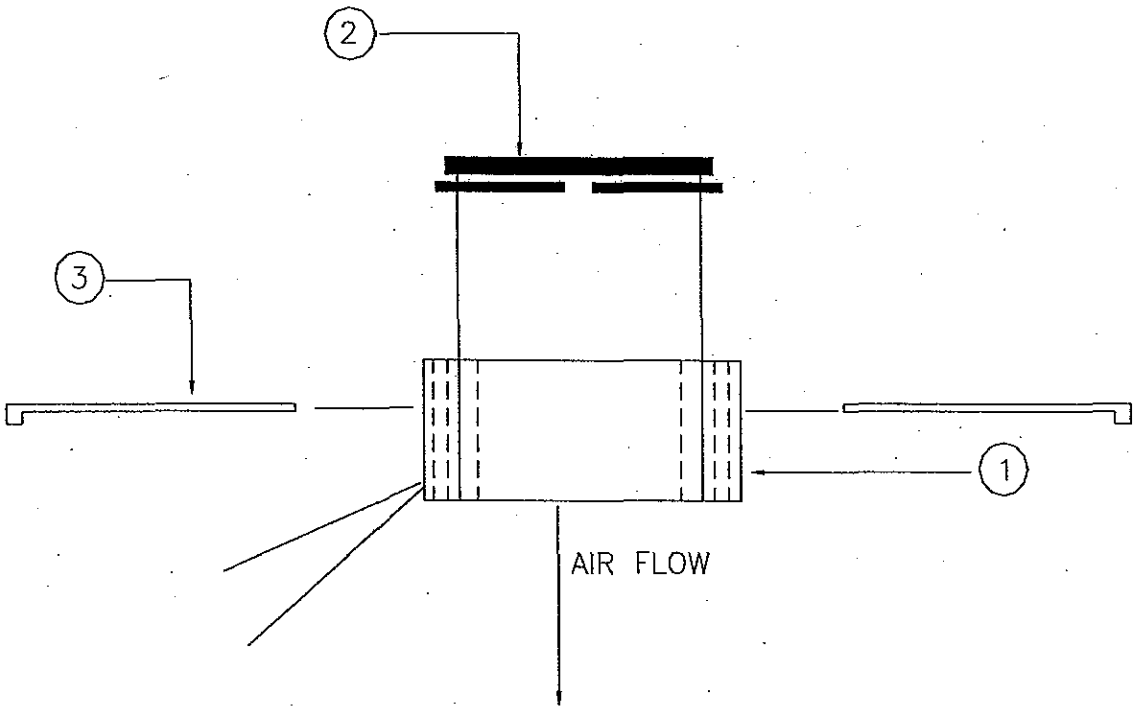
Fan and Guard Assembly, DWG 87402

ITEM	PART NO.	QTY	DESCRIPTION
1	87400	1	Fan
2	87403	1	Fan Guard
3	85056	1	Wire Tie

Fan/Guard Assembly



TOP VIEW



SECTION III

TABLE OF CONTENTS
SECTION III

Materials and Test Equipment Required

1. ***Electronic Calibration / Test Procedure***

   1.1 2-digit Multi-meters (DMM)
   1.2 1-75 ohm, 25 watt, variable wirewound resistor
   1.3 Oscilloscope with 1 probe
   1.4 Water filled tubing set
   1.5 2-test (jumper) leads with clips
   1.6 D.C. variable power supply – 0 to 24vdc at 2amps

2. ***Flow Calibration Procedure***

   2.1 Frequency counter with a modified cable (cable must plug into J6 on the Main PCB).
   2.2 New compatible IV set (do not use IV set that has been sitting with fluid in it).
   2.3 Distilled water (1ml of distilled water equals .9998 grams at 20°C)
   2.4 2-collenction vessels (non-absorbent material).
   2.5 Electronic digital scale (readability to .01grams).

3. ***Occlusion Alarm Check***

   3.1 New compatible IV set
   3.2 1-stopcock
   3.3 30 lb. (PSI) pressure gauge
   3.4 1-collection vessel
   3.5 Distilled water (water source)

4. ***Membrane Replacement Procedure***

   4.1 X-Acto knife with handle (blade #X618)
   4.2 Flat blade screwdriver

Electronic Calibration / Test Procedure

Units with Chopper Drive (CD) PC Board (DWG 86626-2)
Programmable w/Memory Expansion Board (P/N 86692)

This procedure should be completed whenever any repairs have been made to the Main or Display PC Boards. Also if the transformer or associated components have been replaced.

CAUTION: Observe proper electrostatic suppression techniques before attempting any repairs or adjustments toe the PC Boards.

WARNING: Electrical shock hazard exists when unit is plugged into an AC outlet.

NOTE: **Adjust R66 only if any part of the motor oscillator or motor drive circuit has been repaired.*

1. Unplug unit from AC. Remove handle and case, then peel back the plastic cover on the PCB side of the unit (refer to "Case Removal Procedure"). Pull open main PCB and disconnect the battery.
2. Before proceeding with the electronic calibration test, visually inspect the transformer, audio pot, main PCB, voltage regulator cables and battery cables for cold solder joints, frayed wires and/or shorts.
3. Remove the LSI chip (U19), CPU (U25) and Memory Expansion PCB and disconnect J1, J2, J3 and J4.
4. With a suitable screwdriver or tuning wand, turn R22 and R23 20 turns counterclockwise or until the pot clicks. Turn R24 and *R66 20 turns clockwise or until the pot clicks. Back off *R66 about 5 turns.
5. With a DMM set to the 20Kohm scale, check the resistance of TH1. TH1 should be between 4 and 10Kohms.
6. Insure that the 4-pin Molex connector from the voltage regulator is attached to the 4-pin Molex connector on the Main PCB.
7. Using a suitable DMM set to 20vdc, connect the black lead to ground and the red lead to the red battery lead. Connect a second DMM to R25. Set the scale to 2vdc.
8. Plug AC line cord into outlet.
9. Observe the voltage reading on the first DMM. Push the ON/OFF switch and observe the voltage drop. When the voltage returns to the original reading, Q7 is determined to be off. Adjust R22 to 13.6vdc +.005/-.00vdc.
10. Connect a lead from a 75ohm 25-watt adjustable resistor to the black lead of the battery connector and connect a jumper form the red lead of the battery connector to the other end of the 75ohm resistor. The second DMM should read .34 to .38vdc. Disconnect jumper connected to the red lead of the battery from the 75ohm resistor. While observing both meters, run this lead down the resistor (decreasing the resistance) until the 75ohm resistor is shorted. The first DMM connected to the red battery lead should have decreased gradually to <.1vdc (this reading varies with continuity to ground). The second DMM across R25 should have increased but not to exceed 720mV.
11. If unit meets all criteria in the previous adjustments, paint R22 (with fingernail polish or equivalent) and disconnect the 75ohm resistor.
12. With a DMM on 20vdc scale, connect the red lead to the cathode of D11. Insure Q7 is off, as in step 9, prior to making any adjustments. Adjust R23 for 13.90vdc ±.05vdc. Push ON/OFF switch, the voltage should drop to about 13.6vdc, then return to 13.9vdc. This indicates the on/off circuit and the axe circuit are working. Paint R23 and remove the red DMM lead.
13. Connect the red DMM lead to J5 pin 1, DMM must read ≤ .02vdc. Push the ON/OFF switch. DMM should read +5vdc ± .1vdc.
14. Connect the red lead to J5 pin7, DMM must read ≤ .02vdc. Push ON/OFF switch. DMM should read +5 ± .1vdc.
15. Connect the read lead to J5 pin 26. Push ON/OFF switch. Voltage should read about 13.5vdc. Voltage should then gradually decrease to vdc.

Electronic Calibration / Test Procedure (continued)

16. Connect the red lead to J3 pin 1, DMM must read ≤ .02vdc. Push ON/OFF switch. DMM should read +8vdc ± .4vdc.
17. Remove AC power cord from line socket, and then disconnect the DMM leads from the unit.
    NOTE: Before installing U19, clean ICS1 contacts with alcohol using an acid brush followed by electrowash spray. After installing U19, install retaining clip.
18. Still observing proper electrostatic suppression techniques, install the LSI (U19) and the CPU (U25).
    NOTE: Before installing the Memory Expansion Board, bend Q9 and Q10 towards the top of the PCB.
    Install the programmed EPROM (U1) on the Memory Expansion PCB, then install the Memory Expansion PCB into ICS2 (EPROM socket U24) on the Main PCB. Connect J1, J2, J3 and J4 to the Main PCB.
19. Press RATE and enter top row of digits. Unit should display a rate equal to digits pushed and be in the same order. Press RATE again and enter the next row of digits. Unit should display rate equal to digits entered and be in the same order.
20. Press VOL. LIMIT and enter the next row of digits. Unit should display a volume equal to the digits entered and in the same order. Press VOL. LIMIT then CLEAR. The volume display should clear.
21. Enter an amount using "0" and the decimal point (example: 10.2). Volume shown should be equal to digits pushed and be in the same order. Press TOT. VOL., unit should display "TOT 0". Press PIG VOL., unit should display "PIG 0" – "VOL 0". Press PIG RATE, unit should display "PIG 0" – "RATE 0".
22. Press RUN. Unit should go into an audible alarm. While audible alarm is sounding, press SILENCE. Unit should silence. This test ensures that the membrane, matrix and alarm circuits are operating.
23. Turn unit off and unplug unit from AC line outlet.
24. Set DMM to 2000mA scale. Connect DMM in series with the battery by connecting the black lead to the red (+) battery connector, and the red lead to the (+) battery terminal. Turn the unit on. Set the RATE to 100ml/hr and the VOL. LIMIT greater than 5ml.
25. Install the correct tubing set into the unit. Push RUN and note that unit current draw with the motor running is <555mA.
26. While the motor is running, disconnect the motor connector from J4 on the Main PCB. Unit must display "H/L RATE" – "PUSH RUN" with an audio alarm. Reconnect the motor to J4 and push RUN.
27. While the motor is running, open the door. Unit must display "SHUT DOOR" – "PUSH RUN" – "BATT ON" with an audio alarm. Shut the door. Unit will display "IN STOP". Push RUN.
28. While the motor is running, plug the Flow Sensor into the jack on the back panel. Unit must display "IN STOP" – "PUSH RUN" in 4 or less revolutions of the pump. Push RUN. Unit should run with no alarms. After 6 revolutions with no alarm, disconnect the Flow Sensor to from the drip chamber. Unit should display "PROX OCCL" – "EMPT BOTT" in 4 or less revolutions of the pump. Reconnect the Flow Sensor to the drip chamber and push RUN. Unit should run with no alarms. After 6 revolutions, disconnect the Flow Sensor from the jack on the back panel. Unit should display "IN STOP" – "PUSH RUN" in 4 or less revolutions.
29. Turn unit off. Hold the numeric 7 key and push ON. An audible "beep" will sound. Release the #7 key and the unit will display "SNSR OFF". Push the numeric keys 3,0,3 in sequence; unit will then display "SNSR ON". Push OFF.
30. Turn unit on. When unit displays "SET RATE", enter a RATE of 100ml/hr., then enter VOL. of 100ml. Push RUN. Unit will display "FLOW SNSR" and the pump will not start. Install the Flow Sensor and push RUN. Unit starts up. Push STOP then OFF.

Electronic Calibration / Test Procedure (continued)

31. Hold the numeric 7 key down and push ON. After the "beep", push the numeric keys 3,0,3 and the unit should display "SNSR OFF". Push OFF. Turn unit back on and set the RATE and VOL.

Insure Flow Sensor is unplugged from the unit then push RUN. Unit should start up with out the Flow Sensor. Push STOP.

32. Turn the unit off. Sleep Mode current draw is less than 205mA. Turn the unit on. Verify that the unit has retained its memory.
33. Put unit in TEST MODE by holding the numeric 9 key down and pushing ON/OFF switch. Turn the unit off. Unit should be axed and must read less than 350uA. Disconnect DMM from the unit.
34. Disconnect the DMM from the battery and set to 20vdc scale. Connect black DMM lead to ground and red lead to the red battery lead.
35. Connect suitable external, variable DC power supply to the battery connectors (SC4 & SC5). Adjust P/S to 13.8vdc. Turn the unit on.
36. Set the RATE to 1ml/hr and VOL LIMIT to 3ml. Push RUN and insure motor is running with display reading "BATT ON". Motor is determined to be running by observing fluctuating current draw on the power supply.
37. Adjust oscilloscope to 1vdc/cm gain and 5mS/cm sweep. Connect scope ground to unit chassis. Monitor the "LOW BATT" flag on U25 pin 23 with the probe. The voltage should be > 4vdc (logic high).
38. Gradually reduce the external power supply voltage to 10.15vdc. If the unit goes into "LOW BATT" alarm, check R24 to ensure it is turned fully clockwise. With the unit running and not in alarm, monitor U25 pin 23 and adjust R24 counterclockwise until the voltage at in 23 drops to 0.0vdc. At this point the unit should display "LOW BATT". Press SILENCE. Monitor the "PLUG IN" flag on U25 pin 22. The voltage should be > 4vdc. Adjust R24 counterclockwise until U25 pin 22 drops to 0vdc. At this time the unit should display "PLUG IN" with an audible alarm.
39. Increase the variable P/S voltage to 13.8vdc and push OFF then ON. Unit should have retained memory (RATE 1 etc...). Plug unit into AC line then push RUN. Unplug unit from AC.
40. Monitor U25 pin 23 while gradually decreasing the power supply. The "LOW BATT" flag should drop between 11.10 and 11.40vdc. Silence the unit before proceeding. Monitor U25 pin 22 while decreasing the power supply. The "PLUG IN" flag should drop at 10.2 ± .05vdc. If flag drops early, adjust R24 counterclockwise. Repeat steps 39 and 40 until unit is adjusted properly.
41. Turn unit off. Disconnect the external P/S and DMM from the unit.
42. Connect unit's AC power cord to line outlet and put unit into TEST MODE by pressing ON/OFF and holding the numeric 9 key down. Push the PIG VOL switch. Unit must display "ADC X". X must be ≤ 1 or the unit fails.
43. Monitor J6 pin 2 on the Main PCB with an oscilloscope set to 1vdc/cm scale. Ensure that the received pulses are clean and not clipped. Also that the vertical deflection peak is equal to the display readout of the Occlusion reading. Press the PIG RATE switch and the unit should display "OCC X". Use the formula: (OCC) X x.02 = voltage peak at J6 pin 2. Occlusion reading should be > 40, but < 150.
44. Remove the tube set and close the door. Note that the display reads "OCC 0". Turn the audio volume control on the back panel fully clockwise for maximum audio. Set oscilloscope to 50mv/cm scale. Monitor the baseline voltage on J6 pin 2. The baseline voltage should never exceed 25mvdc. Press STOP.
45. With an oscilloscope on the 2vdc/cm scale, monitor the collector of Q7 on the Main PCB. With a jumper connected to the unit's chassis (ground), short the gate of Q10. After not more than 30 seconds, the unit should axe (shut down) and the collector of Q7 should go to 0vdc.
46. Turn unit on. Unit should display "BAD RAM". After unit shuts down, hold the numeric 9 key down and press the ON key. After unit comes up in TEST MODE, turn the unit off. Press the ON switch. After the unit displays "8888 8888" it should display "SET RATE" "RATE 0".

Electronic Calibration / Test Procedure (continued)

47. Turn the unit off. Hold the numeric 8 key and turn the unit on. After the "beep", release the 8 key and the unit should display "TOT OFF". Within 5 seconds, enter the code 3,0,3. Unit should display "TOT ON". Push OFF.
48. Hold the numeric 5 key down and turn the unit on. Within 5 seconds after the "beep" push keys 3,0,3. The unit will display "SET MAX". Push the RATE key; unit should display "MRAT 999".

Enter 20, and then push the RUN/STOP key. Push the VOL. LIMIT key; unit displays "MVOL 9999". Enter 50, and then push the RUN/STOP key. Push OFF.

49. Hold the numeric 4 key down and turn the unit on. Within 5 seconds after the "beep" push the keys 9,5,1. The unit will display "LRAT 0.1", push the keys 3,0,3. The unit should now display "LRAT 1.0". Push OFF.
50. Turn the unit on. When the unit displays "RATE 0", "SET RATE", push the RATE key and enter 25, unit should display "RATE ERR" with an audio alarm. Now enter a RATE of 20, unit should display "RATE 20". Push the VOL. LIMIT and enter 55. Unit should alarm and display "VOL ERR". Now enter a VOL of 50, unit will display "VOL 50".
51. Push the RATE key and enter 0.3. Unit should alarm and display "RATE ERR". No push 1.5. Unit will display "RATE 1.5". Push RUN. While the unit is going through the start up displays push the decimal (.) key twice. Unit displays "KEY LOCK" with an audio alarm. While unit is infusing, the Total Volume Infused (TOT XXXX) should be alternating with the RATE display. Push the decimal (.) key twice; unit should display "NO LOCK". Push the RUN/STOP key; unit displays "IN STOP".
52. Go to section labeled "Program Options" and set unit up according to hospital requirements.
53. Unplug unit and clean any solder flux remaining on PCB (if any repairs to the PCB were completed).
54. Reconnect the battery.
55. If the frequency pot (R66) has been adjusted or any part of the motor oscillator or motor drive repaired, the FLOW CALIBRATION must be checked.
56. If the frequency pot (R66) has NOT been adjusted, nor any part of the motor oscillator or motor drive repaired, carefully replace the sealing bag and reinstall the case and handle. Complete the "Initial Field Check-Out Procedure".

Battery Charge Test Equipment Setup

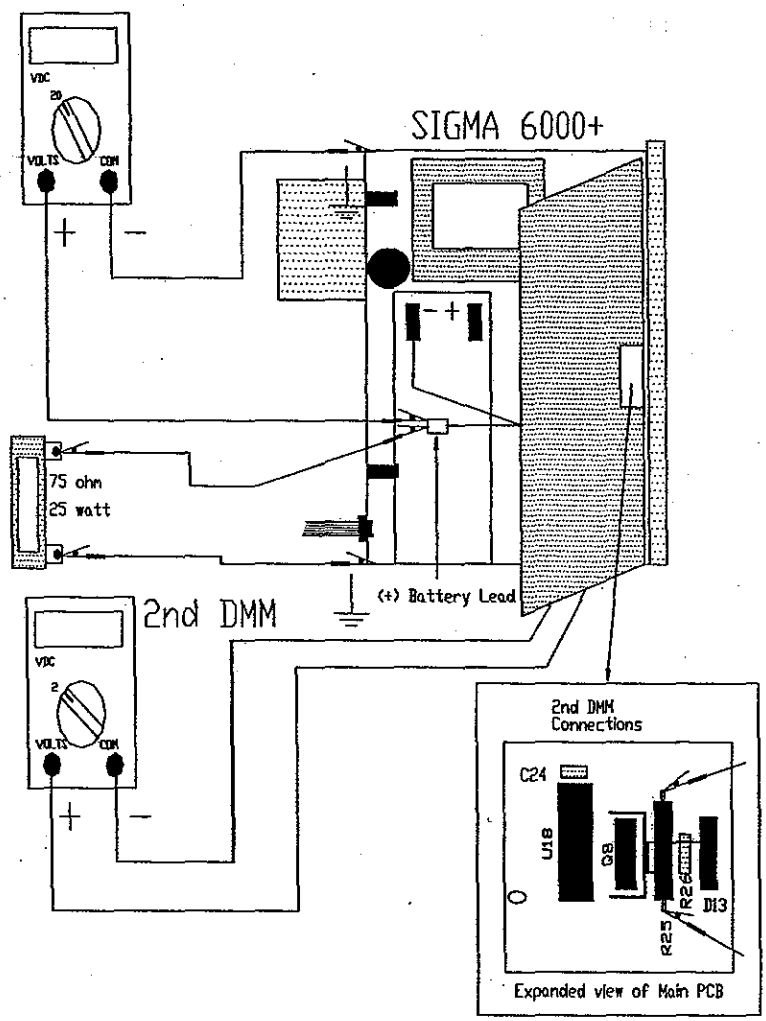


Figure 1

Power Supply Setup (V+ 13.90vdc)

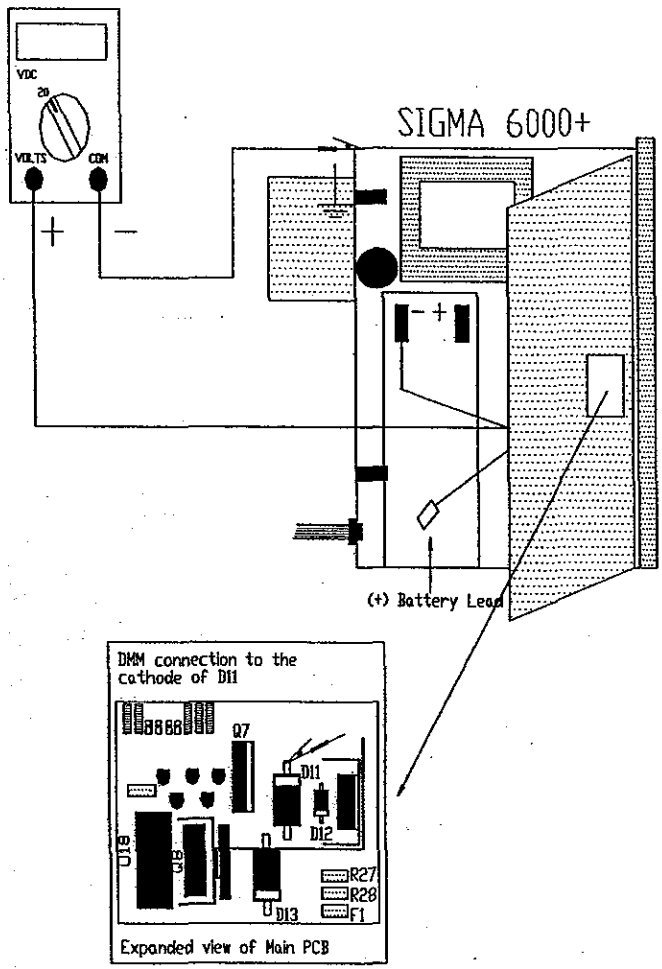

VDC
20
VOLTS
COM
+
−
SIGMA 6000+
− +
(+) Battery Lead
DMM connection to the cathode of D11
Q7
D11
D12
U18
Q8
D13
R27
R28
F1
Expanded view of Main PCB

Figure 2

Current Draw Setup

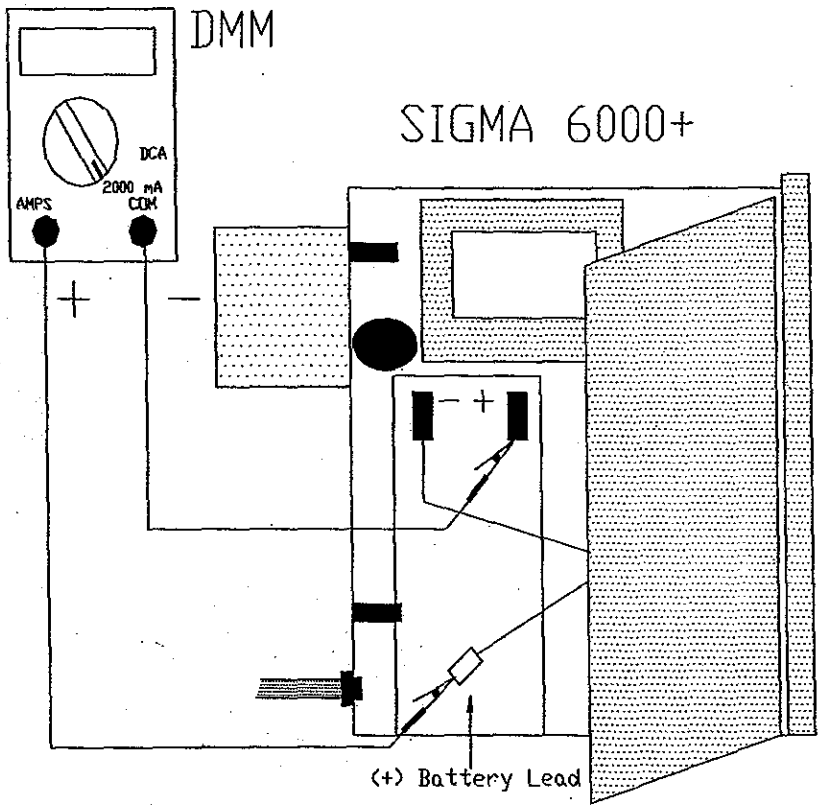


Figure 3

Battery Flag Test Equipment Setup

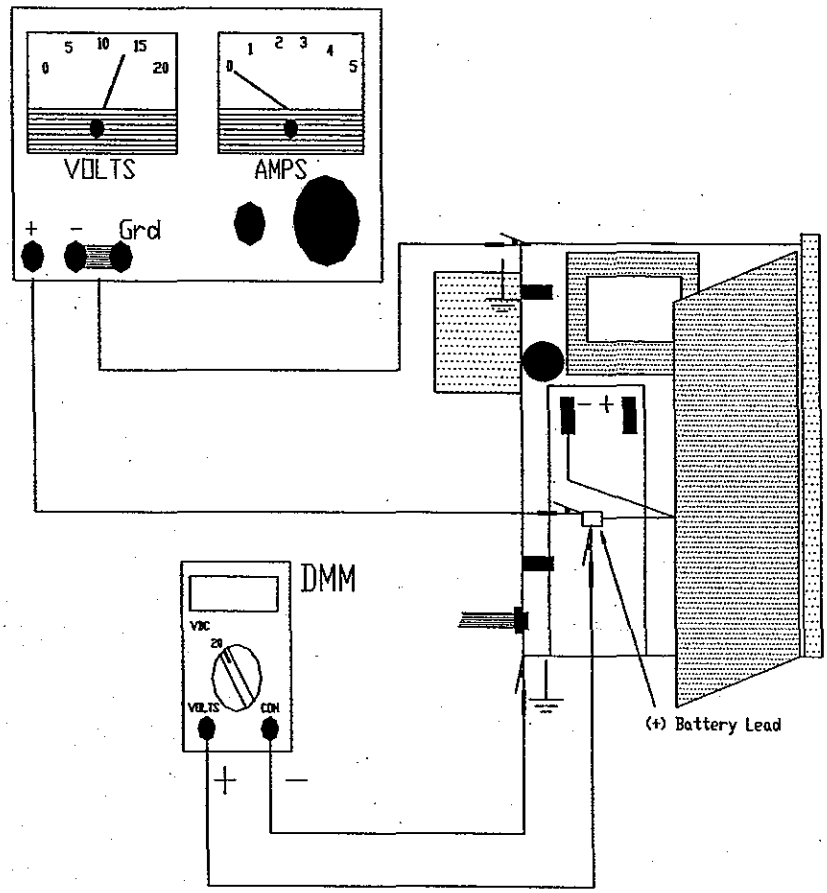


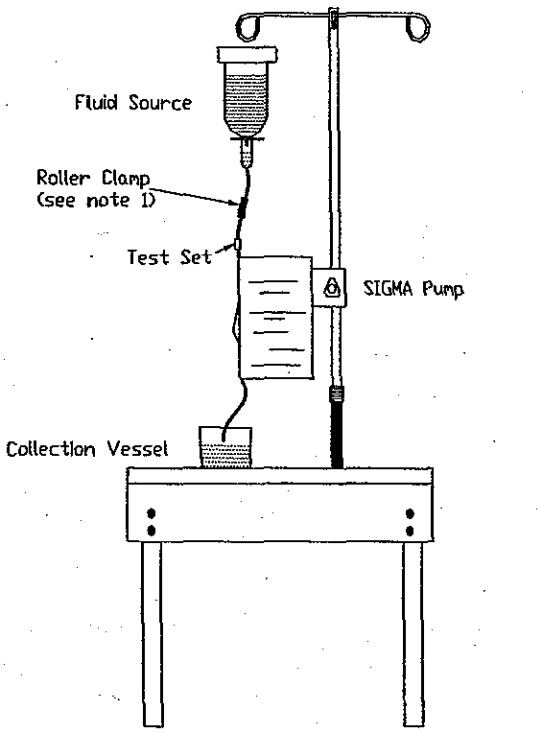
Figure 4

Flow Calibration Procedure

Use this procedure whenever, the unit fails the "Recommended Flow Rate Accuracy Test", located in the service manual, or if R66 (motor frequency adjustment) has been adjusted.

1. ***Frequency Adjustment***
   - 1.1 If any repairs have been made to the "Motor Drive Oscillator" circuit or if R66 has been adjusted for any reason, complete the following step before running the volume test.
     - 1.1.1 Attach a frequency counter to J6 (figure 6), of the Main Printed Circuit Board, using the SIGMA Frequency Test Cable (P/N 87095, see figure 7). Adjust the frequency potentiometer, R66 to an initial frequency of 71Khz ± 0.1Khz.
     - 1.1.2 Remove the test equipment and close the Main PCB.
2. ***Volume Procedure***
   - 2.1 Install a new section of the applicable tube set, of size specified on the test section.
   - 2.2 Set the RATE to 100 ml/hr and the VOL to 25ml. Attach the tube set to the supply tube and the return tube. Prime the set. Load the tubing set into the unit and release the flood stop. Close the door, disconnect the return tube and place the distal end of the tube set into a volume cup below the unit (figure 5).
   - 2.3 Push the RUN/STOP switch. When the unit goes into "RATE KVO" or "INF COMP" (INFUSION COMPLETE), push the "RUN/STOP" switch. Remove the volume cup and weigh the fluid in the volume cup and record on the test sheet.
   - 2.4 Check specifications on the Production Volume Data Sheet (page 12) with the size tubing set used. If the volume reading is within specification, then proceed to step 3, "Final Volume Check". If the reading is not within specification, then continue with this procedure.
   - 2.5 If the reading is not within specification, attach the frequency counter to J65, using the SIGMA Test Cable, of the Main PCB. If the volume reading is lower than specified, adjust R66 clockwise to increase the frequency. If the volume reading is higher than specified, adjust R66 counterclockwise to decrease the frequency.
     - 2.5.1 Increasing the frequency .1Khz increases the volume .1ml. Decreasing the frequency .1Khz will decrease the volume .1ml.
   - 2.6 After adjusting the frequency, install a new tubing section; reset the RATE to 100ml/hr and the VOL to 25ml. Push the RUN/STOP switch. When the unit goes into "RATE KVO" or "INF COMP", push the RUN/STOP switch and weigh the volume.
   - 2.7 Check the weighed volume against the specifications. If the weighed volume falls within specifications, then continue on to step 3 "Final Volume Check". If the volume fails to meet specifications, go back to step 2.1.
3. ***Final Volume Check***
   - 1.1 Attach a new section of the applicable tubing set to the fluid source, prime it and load in the unit. Release the flood stop. Close the door.
   - 1.2 Set the RATE to 400ml/hr and the VOL to 100ml. Remove the return tube from the distal end of the tubing set and place it into a volume cup below the unit.
   - 1.3 Push the RUN/STOP switch. When the unit goes into "RATE KVO" or "INF COMP", push the RUN/STOP switch. Remove the cup. Weigh the fluid in the volume cup and record on the test data sheet.
   - 1.4 If the weighed volume is within the specifications of the Production Volume Data Sheet, paint R66 with finger nail polish (or equivalent) and close the unit.
   - 1.5 If the weighed volume is not within the specifications of the Production Volume Data Sheet, readjust the frequency as in step 2.5 and redo steps 2.1 – 2.4 then section 3.

Flow Calibration Setup



Note 1: Roler Clamp may be used above the unit during testing (for ease of changing Test Sets). During normal operation, the Roller Clamp must be located below the unit.

Figure 5

Production Volume Specifications

Tube Type	**Freq. Range** Low High	**Mot No.**	**Volume Specifications** Tube Size 100/25 400/100				
McGaw	64.1 74.6	1560 1340	.107 24.4 – 25.2 97.3 – 101.5	.108 24.7 – 25.5 98.5 – 102.5	.109 25.0 – 25.8 99.6 – 103.6	.110 25.3 – 26.1 100.8–104.9	
Baxter	66.0 76.8	1515 1302	.101 24.8 – 25.3 99.1 – 101.9	.102 25.1 – 25.6 100.5-103.0	.103 25.4 – 25.9 101.3-104.2	.104 25.6 – 26.2 102.4-105.0	
Abbott	66.0 76.8	1515 1302	.098 24.7 – 25.6 98.5 – 102.8	.099 24.8 – 25.7 99.1 – 103.1	.100 24.9 – 25.8 99.3 – 103.6	.101 25.1 – 26.0 100.0-104.4	.102 25.3 – 26.2 100.9-105.6

Output Test Jack – J6

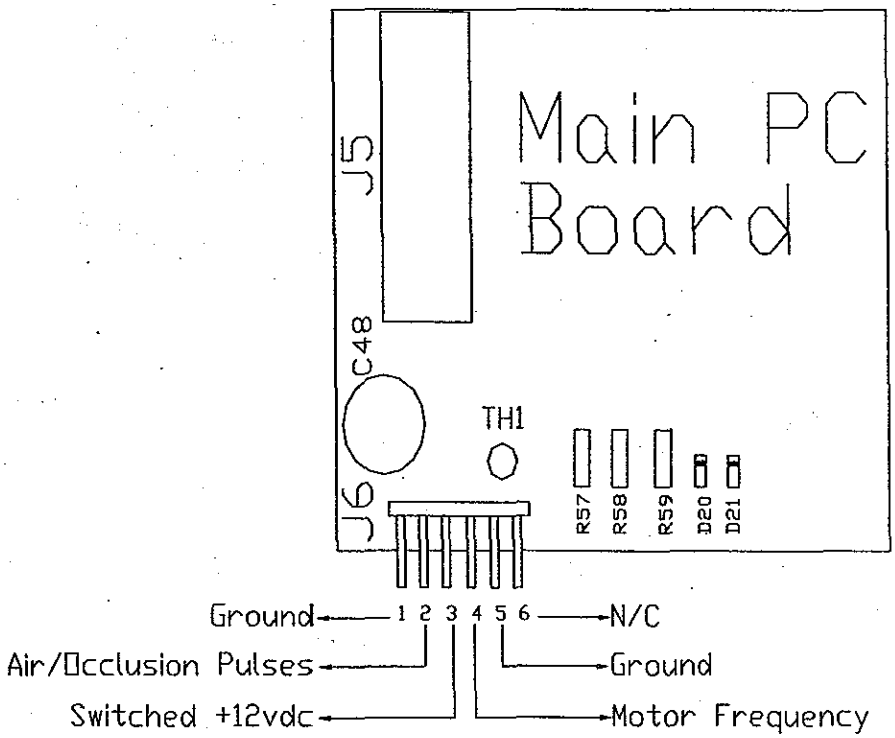
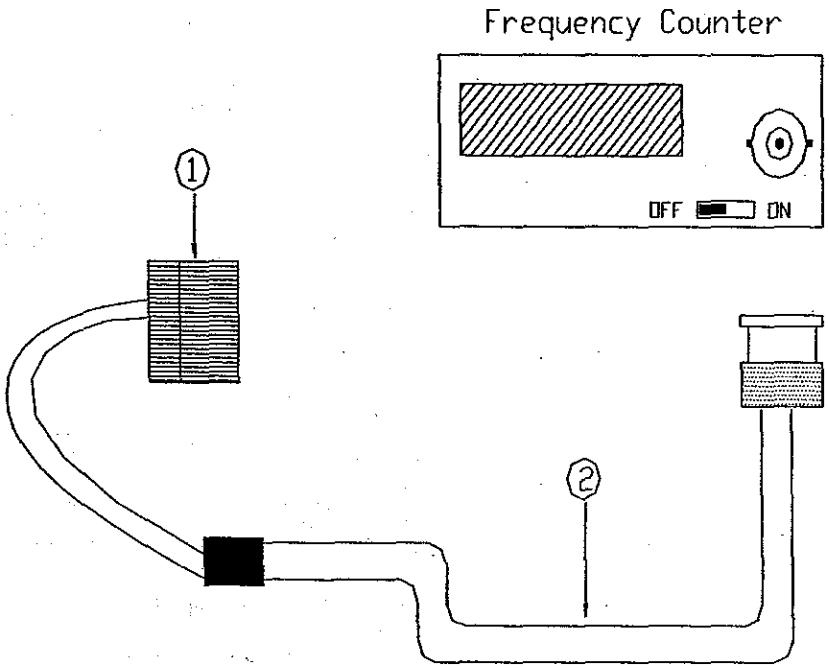


Figure 6

SIGMA Frequency Test Cable (P/N 87095)



1. SIGMA Part Number 87239
   (AMP Part Number 640442-6 or equivalent

2. Pomona Electronics Part Number 4531-C-18 or equivalent

Figure 7

Occlusion Alarm Pressure Check

1. ***Equipment Required***
    - 1.1 30 PSIG pressure gauge
    - 1.2 5 " of tubing (below the unit)
    - 1.3 4 way stopcock
    - 1.4 Fluid Source
    - 1.5 Collection Vessel
2. ***Procedure***
    - 2.1 Set the test tube equipment up according to the illustration below (figure 8).
    - 2.1 Bleed all of the air from the line, stopcock and gauge.
    - 2.2 Turn the unit on and set the RATE to 100ml/hr and the VOL LIMIT to 15ml. With the stopcock open, allow the unit to run for approximately 10 seconds.
    - 2.3 Close the stopcock (pressure gauge in line), and monitor the pressure gauge. The unit must stop and alarm (displaying "CLR OCCL") with the occlusion pressure reading between 6 and 18 PSIG.

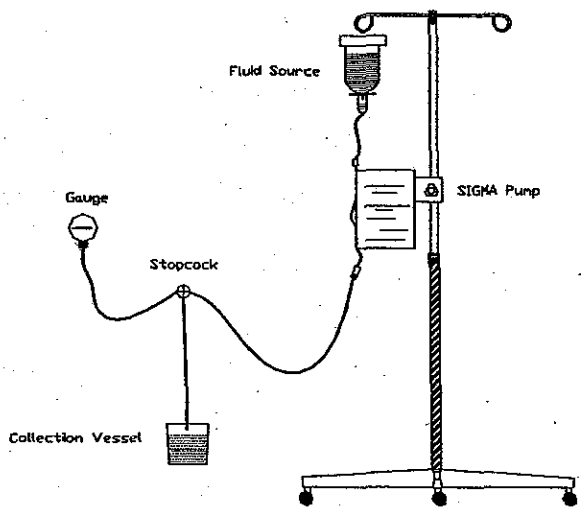


Figure 8

Membrane Replacement Procedure

Replace the membrane switch whenever the switch portion is damaged or the display window is punctured. If the damage was caused by the unit being dropped, then the unit must be returned to the factory for repair.

CAUTION: Observe proper electrostatic suppression techniques before attempting replacement of the membrane.

1. ***Removal***
   - 1.1 Remove the handle and case, using the "Case Removal Procedure" found in the Service Manual.
   - 1.2 Insure unit has been unplugged from AC and disconnect the battery.
   - 1.3 Using an X-Acto handle with a wide flat blade (#X618 or equivalent), start prying the membrane up at the top left corner. As the membrane starts lifting up, use a suitable flat blade screwdriver to pry with instead of the X-Acto.
     CAUTION: When prying, be careful not to damage the displays.
   - 1.4 When the top portion of the membrane has been lifted (down to the display window), start prying on the lower left corner with the X-Acto knife.
   - 1.5 Once the corner has been lifted, use a flat blade screwdriver to finish prying the membrane. Use caution when prying around the membrane connector (located along the right side of the keyboard).
   - 1.6 Once the membrane has been removed, use the X-Acto to remove the remaining adhesive.
     CAUTION: DO NOT use alcohol to remove the glue, as this will damage the displays.
2. ***Installation***
   - 2.1 Remove the paper backing completely from the new membrane switch, being careful not to touch the adhesive.
   - 2.2 Place the bottom edge of the membrane on the bottom edge of the door casting, and hold at approximately a 30°angle to the door (figure 9).
   - 2.3 Slowly move the membrane toward the door and insert the membrane connector into the display jack. When the connector is installed correctly, the membrane switch will align with the door and door latch.
   - 2.4 If the connector is not installed correctly, the membrane switch will either protrude above the top of the door or protrude below the bottom of the door. In either case, carefully remove the membrane and repeat steps 2.2 and 2.3.
   - 2.5 When the switch has been installed properly, press down on the membrane at the keyboard first, insuring good adhesion of the glue. Then press the rest of the membrane to the door.
3. ***Check-Out***
   - 3.1 Plug the unit into the AC. Enter TEST MODE by pressing the ON switch and holding the numeric 9 key down until the EPROM signature is displayed. Release the 9 key. Press the CLEAR key to activate the PROM TEST. When the unit completes the PROM TEST, without a failure message, turn the unit OFF.
   - 1.2 Press the ON switch. The unit will display "8888 8888". After 6 seconds, unit will display "RATE 0", "SET RATE". Push the RATE switch then enter a three-digit value. Unit should display "RATE XXX" (XXX = value entered).
   - 1.3 Press the VOL LIMIT switch and enter a four-digit value. Unit should display "VOL XXXX" (XXXX = value entered).
   - 1.4 Repeat steps 3.2 and 3.3 for the PIG RATE and PIG VOL switches.

Membrane Replacement Procedure (continued)

- 1.5 Press RATE then press the CLEAR switch. Unit should display "RATE 0". Press the decimal (.) switch then press the 5 switch. Unit should display "RATE 0.5".
- 1.6 Press the RUN switch. The unit should display "CHK TUBE" with an audio alarm.
- 1.7 If the unit passes all of the above tests, the membrane has been installed correctly. Reconnect the battery and reassemble the unit.

1.8 If the unit fails any of the above tests, call SIGMA for assistance.

Membrane Installation

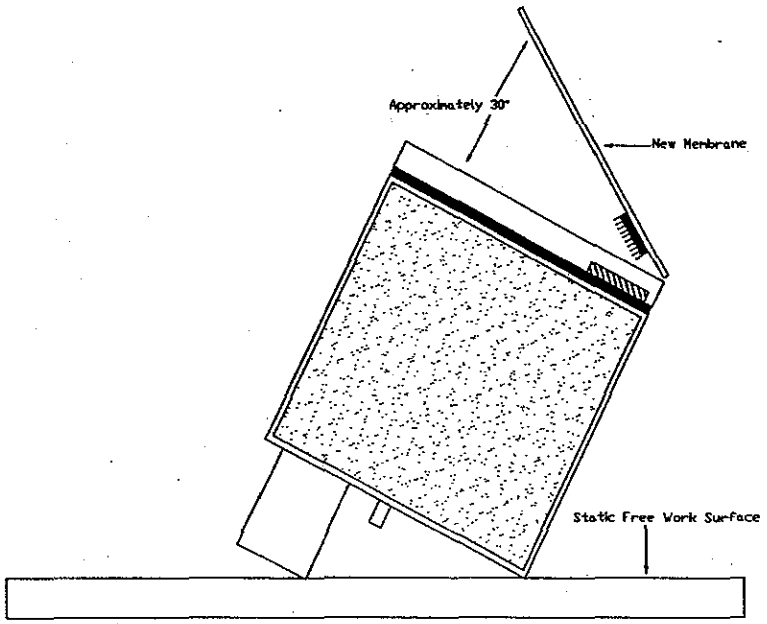


Figure 9

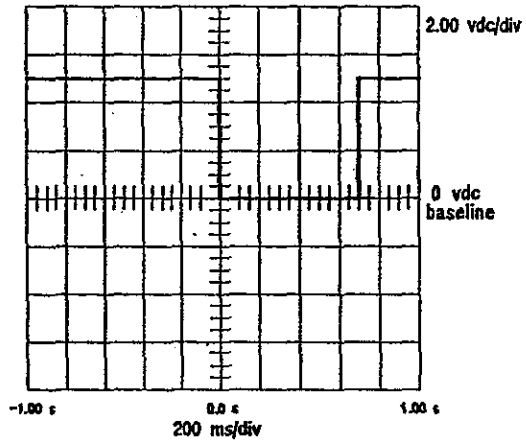
Oscilloscope Signals

Rotation Sensor – J2 Pin 6

Unit in Test Mode – Occlusion Sensor

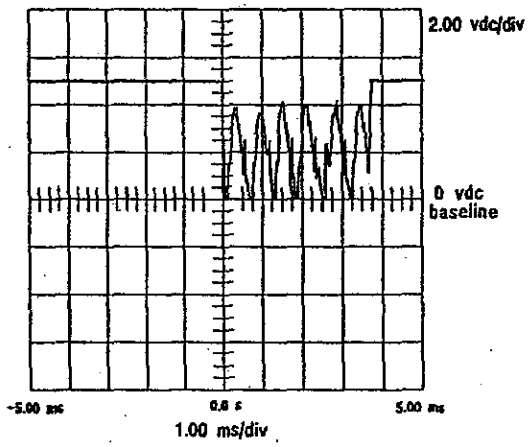
Pulse width will vary according to the RATE unit is programmed for (when unit is operating in Normal Mode).

Figure 10



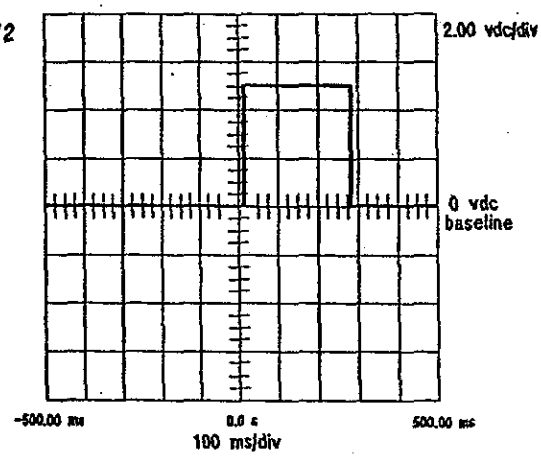
Sensor Transmit Pulse – J1 Pin 1
Unit operating in Test Mode (Occlusion Test)

Figure 11



Keydown – J5 Pin 24
Unit turned ON
Press then release, any numeric or function key (except the ON/OFF key).

Figure 12



Motor Frequency Oscillator – J6 Pin4

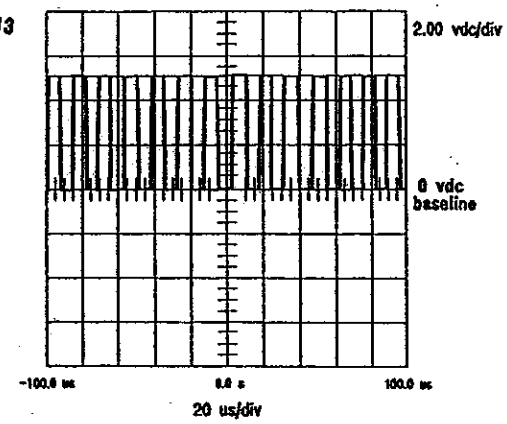
Unit turned On

Frequency should be ± 12% of the center frequency (70kHz)

Refer to the "Motor Oscillator Test" found in the Service Manual, under "Test Mode Procedure"

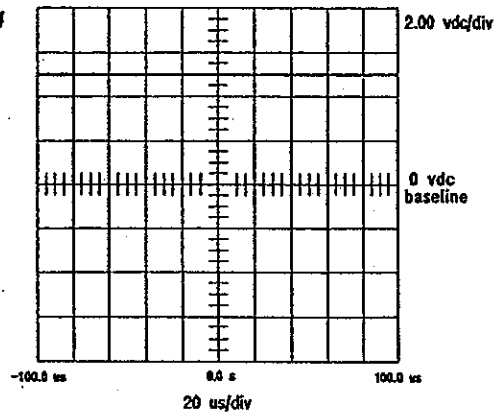
WARNING: Adjusting R66 requires the unit go through the "Flow Calibration Procedure"

Figure 13



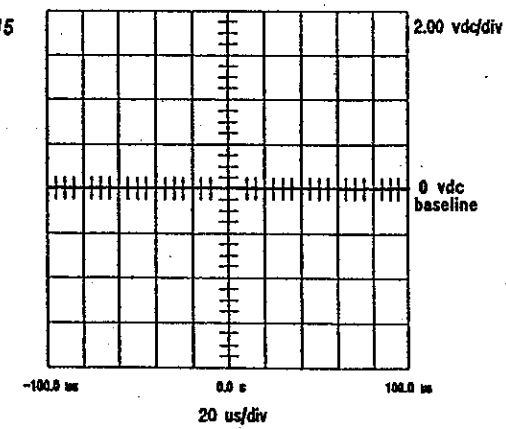
"Battery On" Flag – U25 Pin21
Unit plugged into AC (line voltage) AC indicator ON
Unit turned ON

Figure 14



"Battery On" Flag – U25 pin 21
Unit Unplugged from AC (line voltage)
AC indicator OFF
Unit turned ON, Operating on battery

Figure 15

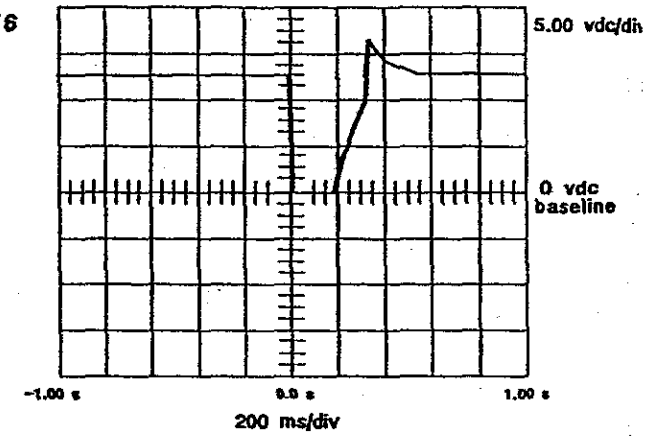


ON/OFF Switch – J5 Pin 25

Unit On or OFF

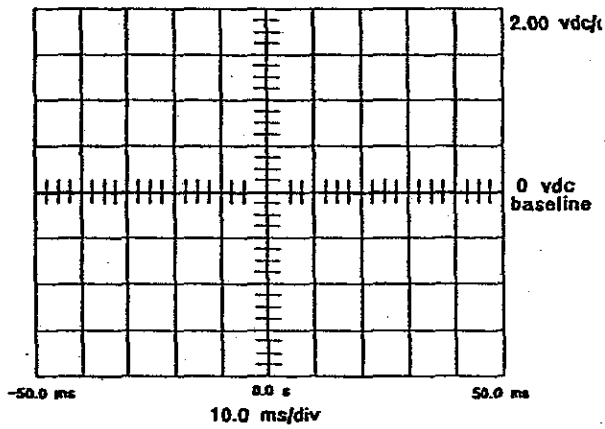
Press then release the ON/OFF switch. Pulse width will vary according to the length of switch actuation.

Figure 16



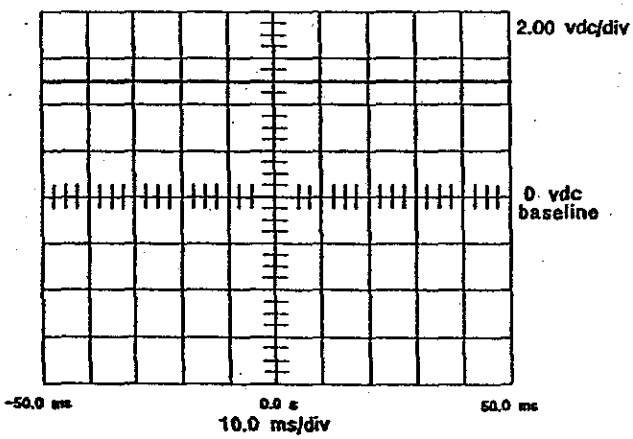
"Door Open" Signal – J2 Pin 3
Unit turned ON
Door closed and latched

Figure 17



"Door Open" Signal – J2 Pin 3
Unit turned ON
Door opened

Figure 18



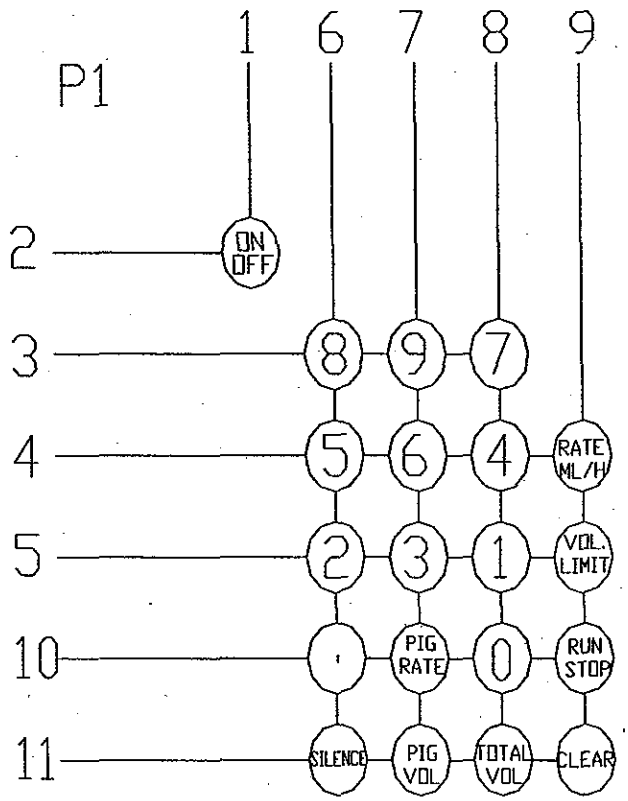
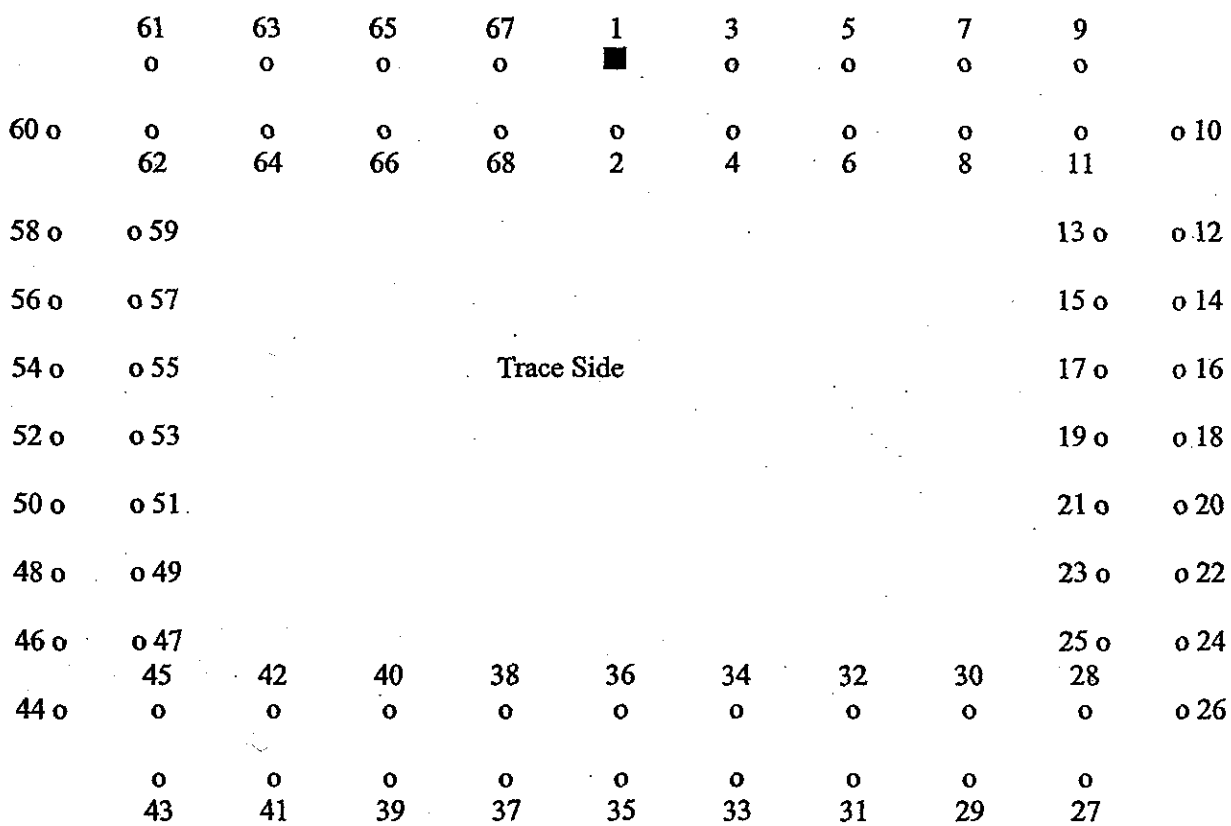

P1
1
6
7
8
9
2
3
4
5
10
11
ON
OFF
8
9
7
5
6
4
RATE
ML/H
2
3
1
VOL.
LIMIT
PIG
RATE
0
RUN
STOP
SILENCE
PIG
VOL
TOTAL
VOL
CLEAR

Figure 19

LSI Chip (U19) Pin-Out

Located on the Main Printed Circuit Board



J5 Pin-Out

Located on the Main Printed Circuit Board

	Pin #		Pin #	
* Not Connected	1A	O O	2A	AC Indicator
+5vdc – Display	1	■ O	2	Chip Enable – DSP1
Chip Enable – DSP2	3	O O	4	Memory Write
Data Bit – 7	5	O O	6	Digit Select – Display IC
Data Bit – 6	7	O O	8	Digit Select – Display IC
Data Bit – 5	9	O O	10	Ground
Date Bit – 4	11	O O	12	Display Blank
Data Bit – 0	13	O O	14	Data Bit – 1
Data Bit – 2	15	O O	16	Data Bit – 3
+5vdc – Logic	17	O O	18	Air/ Occlusion Pulses
Ground	19	O O	20	A/D Out Enable
Memory Read (Low)	21	O O	22	Switch Enable (923)
A/D Enable (CS) (Low)	23	O O	24	Keydown
ON/OFF (Membrane)	25	O O	26	+12vdc – Op Amps

*Pin 1A is connected to Pin 1 on the Display PCB.

(Low) indicates an active low.

Notes:

Field Service Bulletin FSB 93-001 – Door Latch Replacement

PURPOSE: This procedure is intended to provide User Facilities a chronological sequence of steps required to replace the door latch on the SIGMA Model 6000/6000+ infusion pump.

SCOPE: The application of this procedure is limited to biomedical technicians who have satisfactorily completed the SIGMA 2-day or 5-day Service School training class. Door latches should be replaced whenever they are cracked or damaged. If the latch was damaged due to the pump receiving a severe shock (i.e. dropped) it is recommended that the pump be returned to SIGMA for service. SIGMA Standard Operating Procedure (SOP) shall supersede any applicable step of this procedure.

MATERIALS:

SIGMA P/N	Description	Model
87035-1	Latch, Door	6000
87035P-1	Latch, Door	6000+

Note: 1. These part numbers call for latches with the magnet installed, and the latch pin hole reamed $^{3}/_{16}$".
2. It is not necessary to remove the pump case for this procedure.

CAUTION: This equipment contains parts sensitive to damage by ELECTROSTATIC DISCHARGE (ESD). Use ESD precautionary procedures when touching, removing or inserting.

1.0 LATCH REMOVAL

Note: Do not remove the pressure plate. Removal of the pressure plate may result in Flow Rate delivery and Air/Occlusion alarm inaccuracies.

1.1 Position the pump horizontally on a flat surface with the door open.
1.2 Extract the door latch pin.
- 1.2.1 Later model pumps are equipped with a threaded latch pin which is removed with a $^{3}/_{32}$" Hex driver.
- 1.2.2 Earlier model pumps are equipped with a pin that must be driven in the outward direction (away from the pressure plate).

1.3 Retain the latch pin and the two curved washers for the installation of the replacement latch.

2.0 LATCH INSTALLATION

Note: Refer to the Door Assembly drawing in the Service Manual for proper direction while installing the door latch.

2.1 Insert the replacement latch into the latch opening of the door.
2.2 Align the latch pin holes in the door with the door latch hole.
2.3 Insert two curved washers (one each side of the latch) and align with latch pin holes of the door and door latch,
2.4 Insert latch pin.
2.5 Secure latch pin.
- 2.5.1 Latch pins on earlier model pumps (without treaded latch pin) may not fit snug and should be secured by applying Loctite 430 to both ends of the door latch pin.

2.5.2 On pumps equipped with threaded latch pins, apply Loctite accelerator to the exposed latch pin threads of the door assembly. Apply Loctite 430 at the same location afterwards

2.6 Close the door and latch while checking for smooth operation. If the latch operation is tight over the last 15° of travel, or if the latch springs open, then the latch requires a detent notch.

2.6.1 Open door and locate the latch pin located in the front panel (opposite the door latch).

CAUTION: Do not heat the plastic latch, pump fingers or surrounding area.

2.6.2 Carefully direct hot air to the latch pin located in the front panel. Use a small heat gun (max. 750w) with a nozzle deflector. Apply heat to pin for 30 seconds maximum.

2.6.3 Remove heat gun and immediately close door with one hand, then close the latch with your other hand. Hold the latch closed firmly for 10 seconds. **OPEN LATCH AND LEAVE OPEN UNTIL PIN HAS COOLED.** Recheck latch operation.

3.0 OPERATIONAL CHECK

3.1 Verify door sensor operation with "SHUT DOOR" alarm message.

3.2 Perform the Preventative Maintenance inspection located in the Service Manual.

4.0 PART EVALUATION

1.1 Parts which have been damaged from mistreatment may be discarded. If for any reason you believe that the latch has failed through normal usage, please contact the SIGMA Service Manager.

Field Service Bulletin FSB 93-003 – Power Cord Replacement Procedure

PURPOSE: This procedure is intended to provide the User Facilities a chronological sequence of steps required to replace the Power Cord Assembly on the SIGMA 6000+ Programmable infusion pump.

SCOPE: The application of this procedure is limited to biomedical technicians who have satisfactorily completed the SIGMA 2-day or 5-day Service School training class. Power cords should be replaced whenever they malfunction or are damaged. SIGMA Standard Operating Procedures (SOP) shall supersede any applicable step of this procedure.

REFERENCE DRAWINGS:

SIGMA DWG #	Description
86600 – 3	Final Assembly
86604 – 4	Back Panel Assembly

MATERIALS REQUIRED:

SIGMA P/N	Description
86064P	Power cord & strap assembly (grey)
N/A	Shrink tubing, $^{3}/_{16}$" ID, clear, 600v, 125c (ALPHA, FIT 221, or equivalent)
N/A	Flux core solder, (60/40 tin/lead, type RMA)

TOOLS REQUIRED:

Straight-slot Screwdriver (#2)
Diagonal Cutters
Wire Strippers
HEYCO Pliers (#30)
Heat Gun
Wrench, box end ($^{11}/_{32}$")
Solder Iron (35-45w)

CAUTION: This equipment contains parts sensitive to damage by ELECTROSTATIC DISCHARGE (ESD). Use ESD precautionary procedures when touching, removing or inserting.

WARNING: **REMOVE THE AC POWER CORD FROM AC RECEPTACLE PRIOR TO PERFORMING THIS PROCEDURE. RESTORE AC POWER ONLY AS DIRECTED BY THIS PROCEDURE.**

1.0 REMOVE CASE (Refer to DWG 86600-3)

1.1 Remove (2) 8-32 x 1 ¼" screws (Item 12) from pump handle (Item 8).
1.2 Remove (4) 8-32 x $^{3}/_{16}$" screws (Item 10) and (4) external tooth star washers (Item 11) from bottom of case.
1.3 Remove finished case (Item 7) from chassis assembly.
1.4 Very carefully remove sealing bag (Item 5) from chassis, starting from bottom plate.